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EXAMINER	
AUGHENBAUGH, WALTER	
ART UNIT	PAPER NUMBER
1772	10

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	09/890,860	DODD ET AL.
	Examiner	**Art Unit**
	Walter B Aughenbaugh	1772

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *22 May 2003* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *2,3,10-17 and 20-52* is/are pending in the application.

4a) Of the above claim(s) *20 and 21* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *2,3,10-17 and 22-52* is/are rejected.

7)☒ Claim(s) *47,49 and 52* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 9 .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Acknowledgement of Applicant's Amendments

1. The abstract provided on page 2 of Paper 8 filed May 22, 2003 has been received and considered by Examiner.

2. The cancellation of claims 1, 4-9, 18 and 19 in Paper 8 has been acknowledged by Examiner.

3. The amendments made in claims 2, 3, 10, 11, 13-15 and 17 provided on pages 5-6 of Paper 8 have been received and considered by Examiner.

4. New claims 22-52 presented on pages 7-14 of Paper 8 have been received and considered by Examiner.

Election/Restrictions

5. Applicant's election with traverse of Group I, claims 1-19, in Paper No. 8 is acknowledged. The traversal is on the ground(s) that "Applicants disagree with the opinion of the Examiner that evidence of lack of unity is to be found in U.S Patent No. 5,211, 220". This is not found persuasive because U.S Patent No. 5,211, 220 does indeed disclose the features of claim 1 as originally presented as discussed in the 35 U.S.C. 103(a) rejection of claim 1 provided in Paper 6. The requirement is still deemed proper and is therefore made FINAL.

WITHDRAWN REJECTIONS

Claim Rejections - 35 USC § 112

6. The 35 U.S.C. 112 rejection of claim 1 made of record in paragraph 8 of Paper 6 has been withdrawn due to Applicant's cancellation of claim 1 in Paper 8.

7. The 35 U.S.C. 112 rejection of claims 2, 3, 11, 13, 14 and 17 made of record in paragraph 8 of Paper 6 has been withdrawn due to Applicant's amendments in Paper 8.

Claim Rejections - 35 USC § 103

8. The 35 U.S.C. 103 rejection of claims 1-3, 7, 10-13, 14 and 17 made of record in paragraph 10 of Paper 6 has been withdrawn due to Applicant's amendments in Paper 8.

9. The 35 U.S.C. 103 rejection of claims 4 and 5 made of record in paragraph 11 of Paper 6 has been withdrawn due to Applicant's cancellation of claims 4 and 5 in Paper 8.

10. The 35 U.S.C. 103 rejection of claim 6 made of record in paragraph 12 of Paper 6 has been withdrawn due to Applicant's cancellation of claim 6 in Paper 8.

11. The 35 U.S.C. 103 rejection of claims 8 and 9 made of record in paragraph 13 of Paper 6 has been withdrawn due to Applicant's cancellation of claims 8 and 9 in Paper 8.

12. The 35 U.S.C. 103 rejection of claim 15 made of record in paragraph 14 of Paper 6 has been withdrawn due to Applicant's amendments in Paper 8.

13. The 35 U.S.C. 103 rejection of claims 18 and 19 made of record in paragraph 15 of Paper 6 has been withdrawn due to Applicant's cancellation of claims 18 and 19 in Paper 8.

REPEATED REJECTIONS

Claim Rejections - 35 USC § 112

14. The 35 U.S.C. 112 rejection of claim 15 has been repeated for the reasons previously made of record in paragraph 8 of Paper 6.

Claim Rejections - 35 USC § 103

15. The 35 U.S.C. 103 rejection of claim 16 has been repeated for the reasons previously made of record in paragraph 14 of Paper 6.

NEW OBJECTIONS

16. Claims 47, 49 and 52 are objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. In regard to claim 47, the limitations claimed in claim 47 are claimed in claim 46, upon which claim 47 depends. In regard to claims 49 and 52, claim 48, upon which claim 49 depends, and claim 51, upon which claim 52 depends, does not require the metal claimed in claims 49 and 52.

NEW REJECTIONS

Claim Rejections - 35 USC § 112

17. Claims 11, 13, 43 and 51 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In regard to claims 11 and 13, clarification is requested as to how glass fibers would comprise "a continuous tube comprising glass fibre rovings", "tape formed from glass fibre rovings" or "a panel comprising glass fibre rovings" (in regard to claim 11) or a "continuous tube... comprising loosely commingled glass fibre rovings" (in regard to claim 13). Wouldn't, for example, the "continuous tube" comprise the glass fibers in the form of glass fiber rovings?

In regard to claim 43, the structure intended to be recited by the recitation "extending substantially axially of the tubular heat transfer element" and "the direction of the rovings in the other layers extending in at least one plane which intersects the axis at an angle of from about 0° to about 20°" cannot be ascertained.

In regard to claim 51, the structure intended to be recited by the recitation "extending substantially axially of the tubular heat transfer element" and "the direction of the rovings in the other layers extending in at least one plane which intersects the axis at an angle of from about 0 to about 20 degrees" cannot be ascertained.

Furthermore, Claims 43 and 51 are rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential structural cooperative relationships of elements, such omission amounting to a gap between the necessary structural connections. See MPEP § 2172.01. The omitted structural cooperative relationships are: the structural relationship between the "rovings in at least one layer" and the "rovings in the other layers".

Claim Rejections - 35 USC § 103

18. Claims 23, 2, 3, 10-15, 17, 22, 24, 28-32, 35-39, 42-52 are rejected under 35 U.S.C. 103(a) as being unpatentable over Swozil et al.

In regard to claims 23, 2 and 3, Swozil et al. teach a heat transfer element (a tube for a shell and tube heat exchanger, col. 1, lines 37-39) comprising a tube body and a layer of fibers and a fluorine polymer containing a covering that covers each tube wall completely (col. 1, lines 37-45 and col. 1, line 66-col. 2, line 19). Swozil et al. therefore teach a heat transfer element comprising first and second surface layers (the fluorine polymer containing covering of Swozil et al.) and an interior layer between the first and second surface layers where the interior layer comprises a polymer matrix having a fibrous material interspersed therein since the fluorine polymer is coated onto the fibers (col. 1, lines 57-65) and therefore serves as a matrix for the fibers. Swozil et al. teach that the interspersion of fibrous material within the polymer matrix provides rigidity to the heat transfer element (col. 2, lines 12-18). Swozil et al. teach that glass

fibers are a suitable corrosion resistant fiber and that corrosion resistant fibers are necessary (col. 3, lines 1-9). Swozil et al. does not require that the glass fibers comprise boron, and therefore, boron-free glass fibers fall within the scope of glass fibers taught by Swozil et al. Since Swozil et al. teach the use of glass fibers in tube heat exchangers, the glass fibers of Swozil et al. necessarily "act[] as thermally conductive material" as claimed by Applicant.

Swozil et al. fail to explicitly teach that the first and second surface layers consist essentially of polyvinylidene fluoride and that the "fibrous material compris[es] from about 20% by volume to about 60% by volume, based upon the total volume of the heat transfer element" as claimed by Applicant. However, in regard to the polyvinylidene fluoride recitation, Swozil et al. teach that any fluorine containing polymer that can be brought into the fluid state as a melt, solution or dispersion is suitable as the fluorine containing polymer of the first and second layers (col. 3, lines 9-12). Furthermore, Swozil et al. teach that polyvinylidene fluoride is a well known polymer for use in heat exchanger tubes due to its comparatively high use temperatures, very good corrosion and solvent resistance and non-sticking properties (col. 1, lines 9-21). Therefore, one of ordinary skill in the art would have recognized to have used polyvinylidene fluoride as the fluorine containing polymer of the first and second layers since polyvinylidene fluoride is a notoriously well known material for use in heat exchanger tubes due to its comparatively high use temperatures, very good corrosion and solvent resistance and non-sticking properties as taught by Swozil et al.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have used polyvinylidene fluoride as the fluorine containing polymer of the first and second layers since polyvinylidene fluoride is a notoriously well known material for use in

heat exchanger tubes due to its comparatively high use temperatures, very good corrosion and solvent resistance and non-sticking properties as taught by Swozil et al.

In regard to the recitation of the amount of the fibrous material relative to the total volume of the heat transfer element, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have determined the optimum amount of glass fiber in terms of percentage volume of the heat transfer element to use in the heat exchange element of Swozil et al. that would yield the desired rigidity of the element depending on the desired end user result, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art in the absence of unexpected results. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

In further regard to claim 2, the heat transfer element of Swozil et al. is interpreted by Examiner as having the form of a tubular sheet; i.e. of a sheet having two opposite ends that are bonded together to form a tubular structure.

In regard to claim 10, the glass fibers of Swozil et al. are continuous fibers since they are either wrapped around the tube body layer or formed into a mesh sleeve with covers the tube body layer (col. 3, lines 19-50).

In regard to claim 11, Swozil et al. teach the configuration of the fibers in a fabric mesh sleeve with a diameter which corresponds approximately to the diameter of the tube (col. 3, lines 26-34); Swozil et al. therefore teach a continuous tube comprising glass fiber. A fabric mesh of glass fiber necessarily comprises glass fiber rovings plaited (equivalently, interwoven) one with another as claimed by Applicant. Since Swozil et al. teach that the fabric provides rigidity to the

heat transfer element (col. 2, lines 12-18), Swozil et al. teach that the continuous tube comprising glass fiber is a reinforcing element.

In regard to claim 12, the fibers (i.e. rovings as claimed) of Swozil et al. are coated with a plastics material (col. 1, lines 57-65) as discussed above. Furthermore, the term "precoated" introduces a process limitation into the claim that is not given patentable weight since the method of forming the heat transfer element is not pertinent to the patentability of the heat transfer element itself.

In regard to claim 13, Swozil et al. teach a reinforcing element in the shape of a continuous tube having an axis (tubes necessarily have an axis) and comprising glass fiber rovings as discussed in regard to claim 11. Swozil et al. teach that larger mesh widths promote bonding between the fibers and the tube body layer (col. 3, lines 29-39); therefore, Swozil et al. teach that the glass fiber rovings are loosely commingled. Swozil et al. teach that the fibers are oriented cross-wise at an angle of approximately 60° on the tube body (col. 1, lines 49-52). While Swozil et al. fail to explicitly teach that the individual glass fiber rovings each extend substantially in a plane that intersects the tube axis at an angle of about 10° to about 15°, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have determined the optimum angle to orient the fibers relative to the tube axis of the tube of Swozil et al. that would yield the desired rigidity of the element depending on the particular desired end result, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art in the absence of unexpected results. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

In regard to claim 22, Swozil et al. teach that the wall thickness of the tube is from about 0.5 to 2 mm (col. 3, lines 19-23), and therefore teaches that the sheet has a thickness that overlaps with the claimed range of about 0.2mm to about 1.2 mm.

In regard to claim 24, the fluorine polymer of the first and second surface layers of Swozil et al. (polyvinylidene fluoride as established in the 35 U.S.C. 103(a) rejection of claim 23 over Swozil et al. provided above) also serves as the polymer matrix of the interior layer comprising a polymer matrix having a fibrous material interspersed therein since Swozil et al. teach that the fluorine polymer is coated onto the fibers (col. 1, lines 57-65) as discussed in the 35 U.S.C. 103(a) rejection of claim 23 over Swozil et al.

In regard to claim 28, the heat transfer element of Swozil et al. is interpreted by Examiner as having the form of a tubular sheet; i.e. of a sheet having two opposite ends that are bonded together to form a tubular structure. Swozil et al. teach that the wall thickness of the tube is from about 0.5 to 2 mm (col. 3, lines 19-23), and therefore teaches that the sheet has a thickness that overlaps with the claimed range of about 0.2mm to about 1.2 mm.

In regard to claims 14 and 17, Swozil et al. teach a heat transfer element (a tube for a shell and tube heat exchanger, col. 1, lines 37-39) which comprises a polymer sheet (the heat transfer element of Swozil et al. has the form of a tubular sheet; i.e. of a sheet having two opposite ends that are bonded together to form a tubular structure) having first and second outer surfaces and having a fibrous material interspersed therein and comprising a fluoropolymer on the first and second outer surfaces of the sheet (col. 1, lines 37-45 and col. 1, line 66-col. 2, line 19). Swozil et al. teach that the interspersion of fibrous material within the sheet provides rigidity to the heat transfer element (col. 2, lines 12-18). Swozil et al. teach that glass fibers are a suitable

corrosion resistant fiber and that corrosion resistant fibers are necessary (col. 3, lines 1-9). Swozil et al., therefore, teaches that the glass fibers are chemically resistant. Since Swozil et al. teach the use of glass fibers in tube heat exchangers, the glass fibers of Swozil et al. necessarily "act[] as thermally conductive material" as claimed by Applicant.

Swozil et al. fail to explicitly teach that the fluoropolymer is selected from polyvinylidene fluoride or the claimed copolymer, and also fail to explicitly teach that the "fibrous material compris[es] from about 20% by volume to about 60% by volume, based upon the volume of the heat transfer element" as claimed by Applicant. However, in regard to the particular fluoropolymer, Swozil et al. teach that any fluorine containing polymer that can be brought into the fluid state as a melt, solution or dispersion is suitable as the fluorine containing polymer of the first and second layers (col. 3, lines 9-12). Furthermore, Swozil et al. teach that polyvinylidene fluoride is a well known polymer for use in heat exchanger tubes due to its comparatively high use temperatures, very good corrosion and solvent resistance and non-sticking properties (col. 1, lines 9-21). Therefore, one of ordinary skill in the art would have recognized to have used polyvinylidene fluoride as the fluorine containing polymer of the first and second layers since polyvinylidene fluoride is a notoriously well known material for use in heat exchanger tubes due to its comparatively high use temperatures, very good corrosion and solvent resistance and non-sticking properties as taught by Swozil et al.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have used polyvinylidene fluoride as the fluorine containing polymer of the first and second layers since polyvinylidene fluoride is a notoriously well known material for use in

heat exchanger tubes due to its comparatively high use temperatures, very good corrosion and solvent resistance and non-sticking properties as taught by Swozil et al.

In regard to the recitation of the amount of the fibrous material relative to the total volume of the heat transfer element, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have determined the optimum amount of glass fiber in terms of percentage volume of the heat transfer element to use in the heat exchange element of Swozil et al. that would yield the desired rigidity of the element depending on the desired end user result, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art in the absence of unexpected results. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

In regard to claim 15, Swozil et al. teach that an intermediate layer of a plastics material is provided underneath (Examiner interprets "underneath" to indicate "between" the first and second surfaces) the first and second fluoropolymer surfaces of the element, since Swozil et al. teach that the interior layer (between the fluoropolymer surface coating) comprises a polymer matrix (the same fluoropolymer that constitutes the surface coating of both surfaces) having a fibrous material interspersed therein (col. 1, lines 57-65). The polymer matrix of Swozil et al. is the intermediate layer of a plastics material as claimed by Applicant.

In regard to claims 29 and 31, Swozil et al. teach a heat transfer element (a tube for a shell and tube heat exchanger, col. 1, lines 37-39) comprising a tube body and a layer of fibers and a fluorine polymer containing a covering that covers each tube wall completely (col. 1, lines 37-45 and col. 1, line 66-col. 2, line 19). Swozil et al. therefore teach a heat transfer element comprising first and second surface layers (the fluorine polymer containing covering of Swozil et

al.) and an interior layer comprising a polymer matrix having interspersed therein a fibrous material since the fluorine polymer is coated onto the fibers (col. 1, lines 57-65) and therefore serves as a matrix for the fibers. Swozil et al. teach that the glass fibers provide rigidity to the heat transfer element (col. 2, lines 12-18). Swozil et al. teach that glass fibers are a suitable corrosion resistant fiber and that corrosion resistant fibers are necessary (col. 3, lines 1-9); therefore, Swozil et al. teach that the glass fibers are chemically resistant. Since Swozil et al. teach the use of glass fibers in tube heat exchangers, the glass fibers of Swozil et al. necessarily "act as thermally conductive material for conducting heat from the first surface layer to the second surface layer" as claimed by Applicant. The recitation "for conducting heat from the first surface layer to the second surface layer" is an intended use phrase that has not been given patentable weight since it has been held that a recitation with respect to the manner in which a claimed article is intended to be employed does not differentiate the claimed article from a prior art article satisfying the claimed structural limitations. *Ex parte Masham*, 2 USPQd 1647 (1987).

Swozil et al. fail to explicitly teach that the fluoropolymer is selected from polyvinylidene fluoride or the claimed copolymer, and also fail to explicitly teach that the glass fibers are present "in an amount corresponding to from about 20% to about 60% by volume, based upon the total volume of the heat transfer element" as claimed by Applicant. However, in regard to the particular fluoropolymer, Swozil et al. teach that any fluorine containing polymer that can be brought into the fluid state as a melt, solution or dispersion is suitable as the fluorine containing polymer of the first and second layers (col. 3, lines 9-12). Furthermore, Swozil et al. teach that polyvinylidene fluoride is a well known polymer for use in heat exchanger tubes due to its comparatively high use temperatures, very good corrosion and solvent resistance and non-

sticking properties (col. 1, lines 9-21). Therefore, one of ordinary skill in the art would have recognized to have used polyvinylidene fluoride as the fluorine containing polymer of the first and second layers since polyvinylidene fluoride is a notoriously well known material for use in heat exchanger tubes due to its comparatively high use temperatures, very good corrosion and solvent resistance and non-sticking properties as taught by Swozil et al.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have used polyvinylidene fluoride as the fluorine containing polymer of the first and second layers since polyvinylidene fluoride is a notoriously well known material for use in heat exchanger tubes due to its comparatively high use temperatures, very good corrosion and solvent resistance and non-sticking properties as taught by Swozil et al.

In regard to the recitation of the amount of the fibrous material relative to the total volume of the heat transfer element, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have determined the optimum amount of glass fiber in terms of percentage volume of the heat transfer element to use in the heat exchange element of Swozil et al. that would yield the desired rigidity of the element depending on the desired end user result, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art in the absence of unexpected results. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

In regard to claims 36 and 38, Swozil et al. teach the heat transfer element as discussed in the 35 U.S.C. 103(a) rejection to claim 29 provided above. Furthermore, the heat transfer element of Swozil et al. is interpreted by Examiner as having the form of a tubular sheet; i.e. of a sheet having two opposite ends that are bonded together to form a tubular structure. Swozil et al.

teach that the wall thickness of the tube is from about 0.5 to 2 mm (col. 3, lines 19-23), and therefore teaches that the sheet has a thickness that overlaps with the claimed range of about 0.4mm to about 1.2 mm. Swozil et al. teaches that the interior layer is between the first and second surface layers as discussed in the 35 U.S.C. 103(a) rejection to claim 29 provided above.

In regard to claims 30 and 37, Swozil et al. does not require that the glass fibers comprise boron, and therefore, boron-free glass fibers fall within the scope of glass fibers taught by Swozil et al.

In regard to claims 32 and 39, the fluorine polymer of the first and second surface layers of Swozil et al. (polyvinylidene fluoride as established in the 35 U.S.C. 103(a) rejection of claim 29 over Swozil et al. provided above) also serves as the polymer matrix of the interior layer comprising a polymer matrix having a fibrous material interspersed therein since Swozil et al. teach that the fluorine polymer is coated onto the fibers (col. 1, lines 57-65) as discussed in the 35 U.S.C. 103(a) rejection of claim 29 over Swozil et al.

In regard to claim 35, the heat transfer element of Swozil et al. is interpreted by Examiner as having the form of a tubular sheet; i.e. of a sheet having two opposite ends that are bonded together to form a tubular structure. Swozil et al. teach that the wall thickness of the tube is from about 0.5 to 2 mm (col. 3, lines 19-23), and therefore teaches that the sheet has a thickness that overlaps with the claimed range of about 0.2mm to about 1.2 mm.

In regard to claim 42, Swozil et al. teach the heat transfer element as discussed in the 35 U.S.C. 103(a) rejection to claim 36 provided above. Swozil et al. does not require that the glass fibers comprise boron, and therefore, boron-free glass fibers fall within the scope of glass fibers taught by Swozil et al.

In regard to claim 43, Swozil et al. teach a tubular heat transfer element (a tube for a shell and tube heat exchanger, col. 1, lines 37-39) having an axis (a tube necessarily has an axis). Swozil et al. teach that yarn composed of 3000 filaments is wound around the tube and is coated with a fluoropolymer (col. 1, line 57-col. 2, line 35, col. 3, lines 19-43 and col. 4, lines 19-29 and 44-65). Each wind of the yarn of Swozil et al. is structurally equivalent to a layer of tape as claimed by Applicant. Each wind of the yarn of Swozil et al. is laminated one to another as claimed by Applicant since the fluoropolymer coating completely covers the yarn windings, thus connecting (i.e. laminating) the layers (i.e. each of the yarn windings) one to another as claimed by Applicant. Swozil et al. teach that the tape (equivalently the yarn) comprises rovings of chemically resistant glass fiber since the fiber is resistant to corrosive substances (col. 2, line 66-col. 3, line 12). Swozil et al. teach that the glass fiber is impregnated with a fluoropolymer since the fibers are coated with a fluorine-containing polymer (col. 3, lines 4-6).

Swozil et al. fail to explicitly teach that the fluoropolymer is selected from polyvinylidene fluoride or the claimed copolymer, or that the direction of the rovings in at least one layer of tape extends substantially axially of the tubular heat transfer element and the direction of the rovings in the other layers extends in at least one plane which intersects the axis at an angle of from about 0° to about 20°. However, in regard to the polyvinylidene fluoride recitation, Swozil et al. teach that any fluorine containing polymer that can be brought into the fluid state as a melt, solution or dispersion is suitable as the fluorine containing polymer of the first and second layers (col. 3, lines 9-12). Furthermore, Swozil et al. teach that polyvinylidene fluoride is a well known polymer for use in heat exchanger tubes due to its comparatively high use temperatures, very good corrosion and solvent resistance and non-sticking properties (col. 1,

lines 9-21). Therefore, one of ordinary skill in the art would have recognized to have used polyvinylidene fluoride as the fluoropolymer since polyvinylidene fluoride is a notoriously well known material for use in heat exchanger tubes due to its comparatively high use temperatures, very good corrosion and solvent resistance and non-sticking properties as taught by Swozil et al.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have used polyvinylidene fluoride as the fluoropolymer since polyvinylidene fluoride is a notoriously well known material for use in heat exchanger tubes due to its comparatively high use temperatures, very good corrosion and solvent resistance and non-sticking properties as taught by Swozil et al.

Furthermore, Swozil et al. teach that the fibers are oriented cross-wise at an angle of approximately 60° on the tube body (col. 1, line 66-col. 2, line 4 and col. 4, lines 19-23 and 44-48). While Swozil et al. fail to explicitly teach that the direction of the rovings in at least one layer of tape (yarn) extends substantially axially of the tubular heat transfer element and the direction of the rovings in the other layers extends in at least one plane which intersects the axis at an angle of from about 0° to about 20°, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have determined the optimum angles to orient the windings of yarn of Swozil et al. relative to each other that would yield the desired rigidity of the element depending on the particular desired end result, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art in the absence of unexpected results. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

In regard to claim 44, Swozil et al. teach the heat transfer element as discussed in the 35 U.S.C. 103(a) rejection to claim 23 provided above. The polymer of the matrix of the interior

layer of Swozil et al. is the same polymer as the polymer of the first and second layers of Swozil et al. as discussed above.

In regard to claim 45, the heat transfer element of Swozil et al. is interpreted by Examiner as having the form of a tubular sheet; i.e. of a sheet having two opposite ends that are bonded together to form a tubular structure. Swozil et al. teach that the wall thickness of the tube is from about 0.5 to 2 mm (col. 3, lines 19-23), and therefore teaches that the sheet has a thickness that overlaps with the claimed range of from about 0.4 mm to about 1.2 mm.

In regard to claims 46 and 47, Swozil et al. teach the heat transfer element as discussed in the 35 U.S.C. 103(a) rejection to claim 42 provided above. The polymer of the matrix of the interior layer of Swozil et al. is the same polymer as the polymer of the first and second surface layers of Swozil et al. (polyvinylidene fluoride) as discussed above.

In regard to claims 48 and 49, Swozil et al. teach the heat transfer element as discussed in the 35 U.S.C. 103(a) rejection to claim 14 provided above. Swozil et al. does not require that the glass fibers comprise boron, and therefore, boron-free glass fibers fall within the scope of glass fibers taught by Swozil et al. In further regard to claim 48 and in regard to claim 49, claim 48 does not require that the sheet comprise comminuted metal.

In regard to claim 50, Swozil et al. teach the heat transfer element as discussed in the 35 U.S.C. 103(a) rejection to claim 36 provided above. Swozil et al. does not require that the glass fibers comprise boron, and therefore, boron-free glass fibers fall within the scope of glass fibers taught by Swozil et al. Claim 50 does not require that the sheet comprise comminuted metal.

In regard to claim 51, Swozil et al. teach the heat transfer element as discussed in the 35 U.S.C. 103(a) rejection to claim 43 provided above. Swozil et al. does not require that the glass

fibers comprise boron, and therefore, boron-free glass fibers fall within the scope of glass fibers taught by Swozil et al. In further regard to claim 51 and in regard to claim 52, claim 51 does not require that the heat transfer element comprise comminuted metal.

19. Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over Swozil et al. in view of O'Connor.

Swozil et al. teach the heat transfer element as discussed above. Swozil et al. fail to teach that the fibrous material of the heat transfer element comprises metal fibers. O'Connor, however, disclose that suitable materials for the reinforcement of thermoplastic materials are glass fibers and metal fibers or a mixture of glass fibers and metal fibers (col. 3, lines 25-31). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used metal fibers in combination with the glass fibers of Swozil et al. as a reinforcing agent, since it is notoriously well known to use a combination of glass and metal fibers as reinforcing agents of thermoplastic material as taught by O'Connor.

20. Claims 16, 26, 27, 33, 34, 40 and 41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Swozil et al. in view of Yousuf et al.

Swozil et al. teach the heat transfer element as discussed above.

In regard to claim 16, Swozil et al. fail to teach that the plastics material (polyvinylidene fluoride) comprises an acrylic polymer. Yousuf et al., however, disclose a mixture of polyvinylidene fluoride with an acrylic polymer (col. 9, lines 31-36) that yields unusually good flow and levelling characteristics (col. 2, lines 1-6). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used a mixture of polyvinylidene fluoride and an acrylic polymer as the polymer of the plastics material of Swozil

et al. in order to achieve unusually good flow and levelling characteristics during fabrication of the heat transfer element as taught by Yousuf et al.

In regard to claims 26, 27, 33, 34, 40 and 41, Swozil et al. fail to teach that the polymer of the polymer matrix (polyvinylidene fluoride) comprises an acrylic polymer (as claimed in claims 26, 33 and 40) or a mixture of polyvinylidene fluoride and an acrylic polymer (as claimed in claim 27, 34 and 41). Yousuf et al., however, disclose a mixture of polyvinylidene fluoride with an acrylic polymer (col. 9, lines 31-36) that yields unusually good flow and levelling characteristics (col. 2, lines 1-6). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used a mixture of polyvinylidene fluoride and an acrylic polymer as the polymer of the polymer matrix of Swozil et al. in order to achieve unusually good flow and levelling characteristics during fabrication of the heat transfer element as taught by Yousuf et al.

ANSWERS TO APPLICANT'S ARGUMENTS

21. Examiner wishes to point out that Applicant states that polytetrafluroethylene "is not in any event normally regarded as a thermoplastic material" on page 17 of Paper 8 and to make it clear on the record that polytetrafluroethylene is indeed a thermoplastic material, as evidenced, for example, by Gergen et al. (col. 6, lines 28-52). Examiner requests explanation as to how polytetrafluroethylene "is not in any event normally regarded as a thermoplastic material" as Applicant contends.

22. Applicant's arguments on pages 19-25 of Paper 8 regarding the 35 U.S.C. 103(a) rejection of claims 1-3, 7, 10-13, 14 and 17 over Swozil et al. have been fully considered but are not persuasive.

Applicant argues that "Polytetrafluroethylene is not a thermoplastic material". Examiner wises to make it clear on the record that polytetrafluroethylene is indeed a thermoplastic material, as evidenced, for example, by Gergen et al. (col. 6, lines 28-52). In response to Applicant's argument that "it is not stated that [the fibers] impart rigidity to the tube", Swozil et al. teach that the fibers are reinforcing fibers (col. 2, lines 11-37). Reinforcing fibers that reinforce a tube necessarily impart rigidity to the tube. Applicant argues that "there is no teaching to use as much as 20% by volume or more up to 60% of the material of the tube of glass fibers"; Examiner points out that the claims stand rejected under 35 U.S.C. 103, not under 35 U.S.C. 102. Applicant points out that "the Example teaches that only about 60% of the surface of the polytetrafluoroethylene tube is actually covered by fibers"; 1) this is merely an example, 2) the claims presented originally and in Paper 5 did not require that the tube be entirely covered by fibers. Applicant's reliance (on page 20 of Paper 8) on the fact that the Example taught by Swozil et al. teaches that the fibers are carbon fibers and that the fluoropolymer is PFA does not supercede the fact that glass fibers are taught by Swozil et al. and that polyvinylidene fluoride is suggested by the teachings of Swozil et al.

On page 21 of Paper 8, Applicant state that "Swozil et al. teach that the fibres are at risk of affecting adversely the heat transfer coefficients of the coated tubes" and to support this statement cites col. 3, lines 34-36 of Swozil et al. that states "larger meshes only insignificantly change the heat transfer coefficients of the uncoated tubes and are therefore preferred". Applicant then states that "The implication is that, if small meshes are used, the heat transfer coefficient will be adversely affected". Examiner wishes to make clear on the record that Applicant's interpretation of the implication of the cited teaching of Swozil et al. (col. 3, lines

34-36) is the opposite of the teaching of the statement made in col. 3, lines 34-36 of Swozil et al. The statement made in col. 3, lines 34-36 of Swozil et al. teaches that the mesh size DOES NOT (i.e. "only insignificantly") affect the heat transfer coefficient of the coated tubes. Swozil et al does not teach that "the fibres are at risk of affecting adversely the heat transfer coefficients of the coated tubes" as Applicant asserts. While Swozil et al. does not explicitly teach that the glass fibers provides good heat transfer characteristics, the glass fibers of Swozil et al. necessarily must do so since the fibers are used as a component of the heat transfer element of Swozil et al.

In response to Applicant's critique of Examiner's use of the phrase "dual layer tube heat exchanger", Swozil et al. does indeed teach a "dual layer tube heat exchanger", but does not limit the scope of the invention to such; Swozil et al. teaches that "the coating covers each tube wall completely" (col. 2, lines 18-20), i.e. both "faces", in Applicant's words, of the tube is covered by the coating.

The passage that Applicant cites on page 22 of Paper 8 is not directed to the invention of Swozil et al., as Applicant has presented it, but to the prior art.

Applicant's discussion on page 23 of Paper 8 is directed to a patent that was not relied upon in the art rejections presented in Paper 6, and is therefore irrelevant. The motivation to use polyvinylidene fluoride as the fluoropolymer as taught by Swozil et al. is clearly established in the rejection to the appropriate claims presented in this Office Action (Paper 10).

In response to Applicant's argument that "the reason for incorporation of such a high percentage volume of glass fibers in the Applicant's heat transfer element is not simply to impart rigidity but rather to ensure that the heat transfer element has the desired good heat transfer properties" on page 24 of Paper 8, the fact that Applicant uses the glass fibers for a different purpose does not

alter the conclusion that its use in a prior art device would be *prima facie* obviousness from the purpose disclosed in the reference. *In re Lintner*, 173 USPQ 560. Applicant's statement that "Swozil et al. implicitly teach that use of too high an amount of fibres is disadvantageous because they can change significantly the heat transfer coefficients of the uncoated tubes" is incorrect as discussed above; Swozil et al. teaches that the mesh size (therefore, amount of fiber) DOES NOT (i.e. "only insignificantly"-INsignificantly) affect the heat transfer coefficient of the coated tubes (col. 3, lines 34-36). In response to Applicant's argument that Swozil et al. teaches "wrapping a limited part only of the outside of a tube of a different polymer from that with which the fibres are impregnated", the limitations on which the Applicant relies are not stated in the claims. It is the claims that define the claimed invention, and it is the claims, not specifications that are anticipated or unpatentable. *Constant v. Advanced Micro-Devices Inc.*, 7 USPQ2d 1064. Also note that Swozil teaches coating both walls of the tube (col. 2, lines 18-20), not solely the outside of the tube, as discussed above.

Contrary to Applicant's assertion on page 25 of Paper 8, a mesh, by definition, is formed of a plurality of loosely commingled fibers. Applicant's argument regarding to "catch[ing] fish" is entirely irrelevant to the instant application.

23. Applicant's arguments on page 26 of Paper 8 regarding the 35 U.S.C. 103(a) rejection of claims 15 and 16 over Swozil et al. in view of Saito et al. have been fully considered but are not persuasive.

While Applicant asserts that the "water soluble acrylic resin... would also be pyrolyzed in the calcining step at 400°C", Saito et al. does not explicitly disclose the subject matter of this assertion. As made of record in paragraph 14 of Paper 6, the acrylic resin serves as a binder

which comprises inorganic filler and therefore is necessarily a component of the final product taught by the combination of Swozil et al. and Saito et al.

24. Applicant's arguments on pages 26-28 of Paper 8 regarding the 35 U.S.C. 103(a) rejection of claims 18 and 19 over Swozil et al. in view of Yousuf et al. have been fully considered but are not persuasive.

Applicant's argue that the disclosure of Yousuf et al. is "from a totally different art from the Applicant's invention and has nothing at all to do with the manufacture of heat transfer elements", but the disclosure of Yousuf et al. does indeed pertain to the instant application because Yousuf et al. discloses a means of facilitating the processing of polyvinylidene fluoride, i.e. mixing polyvinylidene fluoride with an acrylic polymer. One producing the heat transfer element as instantly claimed would be motivated to consult Yousuf et al. in order to determine how to facilitate the processing of polyvinylidene fluoride. Applicants once again argue that "Swozil et al. teach that the whole outer surface of [the] polytetrafluoroethylene tube should not be covered with glass fibers since that would have an adverse effect upon the heat transfer characteristics"; again, this is not suggested by Swozil et al. as discussed above.

Conclusion

25. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after

the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

26. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Walter B. Aughenbaugh whose telephone number is 703-305-4511. The examiner can normally be reached on Monday-Thursday from 9:00am to 6:00pm and on alternate Fridays from 9:00am to 5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Harold Pyon, can be reached on 703-308-4251. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9310.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.

wba
08/11/03 WBA

HAROLD PYON
SUPERVISORY PATENT EXAMINER
1772 8/11/03